



**FACULTY OF AGRICULTURAL SCIENCES AND ALLIED INDUSTRIES**

## MUTIPURPOSE TREE SPECIES

**The multipurpose tree species (MPTs)** is a plant species that is purposefully grown so as to provide two or more than two products and also service function like shelter, shade, land sustainability of the land-use system. Many woody perennial species may be 'multipurpose' in one kind of system but 'single purpose' in another.

### VARIOUS BENEFITS FROM MPTS

#### FOOD

1. Human food from trees (fruits, nuts, leaves, cereal substitutes, etc).
2. Livestock feed from trees (one step down the trophic chain).
3. Fertilizer trees for improving the nutritional status of food and feed crops through:
  - (a) Nitrogen fixation
  - (b) Access to greater volume of soil nutrients through deep rooting trees
  - (c) Improved availability of nutrients associated with higher cation exchange capacity and organic matter levels.
4. Soil and water conservation.
5. Environment amelioration.

#### WATER

1. Improvement of soil moisture-retention in rain-fed cropping systems and pastures through improved soil structure and microclimate effects of trees.
2. Regulation of stream flow for reduction of flood hazard and more even supply of water, through reduction of run-off and improvement of interception and storage in infiltration galleries, through various watershed protection practices involving trees.
3. Protection of irrigation works by hedgerows of trees.
4. Improvement of drainage from waterlogged or saline soils by phreatophytic trees.
5. Increased biomass storage of water for animal consumption in forage and fodder trees (higher water content of tree fodder in dry season).

#### ENERGY

1. Firewood for direct combustion
2. Pyrolytic conversion products (charcoal, oil, gas).
3. Produces gas from wood or charcoal feedstocks.
4. Ethanol from fermentation of high-carbohydrate fruits.
5. Methanol from destructive distillation or catalytic synthesis processes using woody feedstock.
6. Oils, latex, other combustible saps and resins.

7. Augmentation of wind power using appropriate arrangements of trees to create venturi effects (wind power is proportional to the cube of wind velocity).

## **SHELTER**

1. Building materials for shelter construction
2. Shade trees for humans, livestock and shade-loving crops.
3. Wind-breaks and shelter-belts for protection of settlements, cropland and pasture.
4. Living fences.

## **RAW MATERIALS FOR PROCESSING**

1. Wood for a variety of craft purposes.
2. Fibre for weaving industries.
3. Fruits, nuts etc. for drying or other food-processing industries.
4. Tannins, essential oil, medicinal ingredients etc.

## **CASH**

1. Direct cash benefits from sale of above-listed products.
2. Indirect cash benefits from productivity increases (or input savings)
3. Via associated crops or livestock.

## **SOCIAL PRODUCTION**

1. Production of goods for socially motivated exchange (e.g. cattle for bride price, ceremonial foods etc.)
2. Increased cash for social purposes (ritual expenses, development levels, political contributions etc.)

## **CHARACTERISTICS OF MPTS**

**Multipurpose trees species should fulfil the following criteria:**

- Wider adaptability to local climatic conditions.
- Thin and sparse crown that allows sunlight enter into the system
- Capacity to withstand various management practices like coppicing, lopping and pollarding etc.
- Quick sprouting habit.
- Productive capacity that includes poles, wood, food, fodder, medicinal and other products.
- Good leaf litter making nutrients available at appropriate times in the crop cycle.
- Few and shallow lateral roots (or prunable).
- Ability to assist in nitrogen fixation.
- Resistance to drought, flooding, soil variability and other climatic hazards.
- Deep thrusting taproot system.
- Easy to manage

- Cheap to establish
- Higher demand and better value for the produce.

### MANAGEMENT STRATEGY FOR MPTS

| MANAGEMENT | STRATEGY | FOR | MPTS |
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- Having chosen the forestry and agricultural components of an agroforestry system suited to the site, the management strategy which maximizes the value of the system must be developed.
- Probably the most important factor affecting the management strategy is the nature of the relationship between the over-storey of trees and the under-storey agricultural crops.
- Management in horizontal dimension (water and nutrient limiting)
  - Changing spacing
  - Zonal arrangement-Macro/micro
  - Mixed cropping
- Management in vertical dimension (light limiting, nutrient and moisture in plenty)
  - Growing species at different times
  - Growing species of different heights in such manner that smaller mature before tallest one
  - Under storey crops can be given extra light at certain times of the year depending upon leaf fall or by tree pruning
  - Growing species which attains similar heights but with different life cycle
- Management in time dimension
  - If component not fully utilize environmental resources available throughout the year, yield can be increased skillfully by:
- Choosing species and cultivars according to phenology, stature, habit, produce etc.
- Staggering planting, relay planting etc
- Management practices: (for tree crops)
  - Initial tree spacing
  - Management practices
- Thinning, pruning, coppicing, pollarding, bending, bushing etc

INITIAL

SPACING

- Dependent on growth rate of the trees
- Final crop stock depends on
  - Relative value of the tree and agriculture crops
  - Environmental factors affecting availability of nutrients, moisture and soil space
  - Latitude and aspect which affect the availability of incoming radiation
  - Performance of tree crop
  - Performance of agriculture crop

- Management considerations-machinery
- Personal preferences

## MANAGEMENT PRACTICES

### Thinning

Felling made in immature stand for the purpose of improving the growth and form of the trees that remain without permanently breaking the canopy. It is mainly done:

- To improve the hygiene of the crop by removing dead, dying and diseased trees
- To ensure best physical conditions of growth
- To obtain a desired type of crop
- To afford protection from the spread of insects and diseases
- To improve the quality of wood
- Increase the net yield and financial return from the crop

### Pruning

- Removal of live or dead branches or multiple leaders from standing trees for the improvement of the tree or its timber.
- It allows the grower to manipulate the growth and development of the trees left after thinning to improve the quality of the tree and to increase agriculture returns
  - Natural; natural death and fall of branches of standing trees grown closely due to deficiency of light or decay etc
  - Artificial: Removal of branches with sharp tools in a dense crop.
  - Pruning lower branches close to the trunk of tree makes small knotty core which gives clear straight grain timber.
  - Removal of too many branches will retard the growth
  - If pruning is done too late, the central core of knotty wood become large thus reducing value of tree

### Pollarding:

Pollarding consists of cutting a sapling or pole tree at some height above the ground level so that it produces new shoots from below the cut. Pollarding is done at a height of 2- 2.5 m above ground level; e.g. in *Salix* spp., *Hardwickia binata*, *Grewia optiva*, *Morus alba*, etc.

### Lopping:

Removal of one year shoots or fresh growth from entire crown of the tree/plant in order to get sufficient fodder for livestock is known as lopping. Lopping is extensively done in *Morus*, *Grewia*, *Bauhinia*, etc.

### Coppicing:

Cutting or heading back of main stem at 20-30 cm from the ground level. Strong coppicers: *Acacia catechu*, *Albizia lebbek*, *Anogeissus latifolia*, etc.; Good coppicers: *Aesculus indica*, *Chloroxylon swietinia*, *Hardwickia binata*, etc.; Bad

coppicers: *Adina cordifolia*, *Bambax ceiba*, etc.; and Non coppicers: All conifers.

**Bending:**

Restricting the development of bole to allow more food material to new leaf shoots. Bending and coppicing are useful when it is desirable to produce large quantity of foliage close to ground level.

**Training:**

In agroforestry vertical spread of the tree is a desirable feature, therefore trees raised in agroforestry systems must be vertically trained to avoid shade and light competition to underground crop.